On the SOLUTION *of* LEAD *by* LIME.

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IN the year 1787 I obſerved that the lining of milled lead, which covered the inſide of a water ciſtern, was corroded, in ſome places, ſuperficially, in others, quite throughout, ſo as to ſuffer the water to eſcape.

THE holes were ſmall and ragged at their edges. The lead was about one-twelfth of an inch thick.

THE plumber, who was employed to repair it, imputed the accident to ſome mortar which had accidentally fallen into the ciſtern, and lain on its bottom a conſiderable time; conſidering this circumſtance as worthy of ſome inveſtigation, I tried the following experiments with a view of aſcertaining in what manner the corroſion took place, and particularly of determining how far it might be promoted by the contact of air.

THESE experiments were begun on the 26th of September 1788.

THE following mixtures were then made:

N°. 1, 100 grains of lead filings with the ſame quantity of lime and three ounces of diſtilled water.—Theſe were put into a phial which was carefully corked, ſo as to exclude the air.

N°. 2.—The ſame quantities of lime, lead and water, in a bottle, which was left uncorked. A piece of lead wire, one-twelfth of an inch diameter, which weighed 30 grains, was put into each of thoſe bottles.

N°. 3.—A ſimilar piece of lead wire, with about two ounces of lime water, was put into a phial, which was corked. The phial contained ſome air.

AUGUST 24th, 1790. The contents of theſe phials were examined. The ſurface of the wire in N°. 1. appeared bright and metallic; its weight was thirty grains exactly: Hepatic air, paſſed through the liquor, ſcarcely produced any tinge. The piece of wire in N°. 2. weighed twenty-eight grains; this was covered with a whitiſh grey ſcale, which was ſcraped off before the lead was weighed; the water of the mixture had been, at ſome time which I could not aſcertain, ſpilled by the fall of the phial; the lime at the bottom of the phial appeared ſlightly cauſtic. The wire in N°. 3. was covered with a cruſt like that in N°. 2; this cruſt being ſeparated, though not completely, by bending the wire backwards and forwards, the wire weighed twenty-nine grains.

AUGUST

AUGUST 30th, 1790. The mixture of lime and lead in N°. 2, which was now dry, was triturated with one ounce of diſtilled water, and filtered; the liquor on being expoſed to air was ſoon covered with a pellicle like lime water; on paſſing hepatic air through it, it acquired a ſlight browniſh tinge.

AUGUST 6th, 1791. Six hundred grains of lime, and the ſame quantity of lead, cut ſmall, were put into a phial, with about five ounces of water; this was ſuffered to ſtand, corked, until the 9th of October 1792; the liquor was then poured off; when filtered it ſtruck a ſlight browniſh colour with hepatic air; eight ounces of diſtilled water were boiled with the reſiduum; the filtered liquor, by evaporation, yielded an extract of ſeven grains; marine acid was added to this extract: the ſolution was not complete; a powder, probably plumbum corneum, remaining at the bottom of the veſſel, which weighed two grains.

ON Auguſt 6th, 1791, the ſame quantities of lead and lime, as in the former experiment, were made into a paſte with diſtilled water; this was ſuffered to dry in the open air, and the lime cake, containing lead, was examined on the 9th of October 1792; it was then dry, but during the abovementioned interval of fourteen months it had been wetted two or three times. When examined it weighed fifteen hundred and ninety grains; each ſmall particle of lead appeared ſurrounded with a yellowiſh ring, which extended to ſome diſtance in the lime

cake; this cake was powdered and boiled with ſix ounces meaſures of diſtilled water for half an hour. The filtered liquor ſtruck a deep black colour, with hepatic air and ſolution of hepar ſulphuris; and depoſited a white precipitate on the addition of marine acid, and a ſolution of neutral arſenical ſalt. From the encreaſed weight of the cake it appears probable that it had attracted fixed air from the atmoſphere.

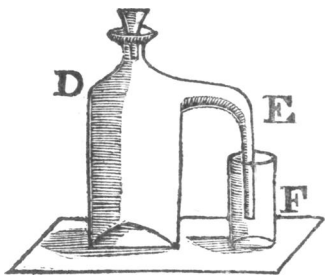
FROM the foregoing experiments it was inferred that lime acts imperfectly, perhaps not at all, upon lead, without the aſſiſtance of air to calcine the metal.

THE following experiments were made in order to aſcertain the action of lime upon lead, in different ſtates of calcination. I took ten grains of finely powdered lithrage *a*, the ſame quantity of calx of lead precipitated from nitrous acid by volatile alcali *b*, and the ſame weight of minium *c*; to *a* and *b* were added four ounces by meaſure of lime water made by boiling lime with the pureſt diſtilled water. The ſpecific gravity of this lime water at the temperature 60 was 1003; to *c* were added four ounces and a half of the ſame lime water.

THE mixtures were all put into phials which contained them exactly; to each of theſe ſtoppers were carefully adapted, ſo ſo as to exclude the air completely; the phials were placed in ſand, which, for ſeveral days together, was heated to one hundred degrees. After they had ſtood for thirty days, during which time they were often ſhaken, the liquors were filtered, and the powders that remained undiſſolved were

were carefully collected on filtering papers; theſe, with the powders upon them, were dried and weighed; the papers were then exactly cleared of the powders, and again weighed; by this means the reſiduum of *a* was found to be 7,9 grains; of *b* 6,6 grains, and of *c* 8,3 grains; ſo that four ounce meaſures of pure lime water diſſolved of litharge 2,1 grains, of calx 3,4 grains, and four ounces and a half of the ſame liquor diſſolved, 1,7 grains of minium. All the filtered liquors ſtruck a deep black colour with hepatic air, and let fall a white precipitate on the addition of marine acid.

To the production of the black precipitate, afforded by hepatic air, the preſence of atmoſpheric, or rather vital air, appears to be neceſſary, as may be inferred from the following obſervation: Hepatic air was generated in the phial D, to the ſide of which was adapted the bent tube E, whoſe extremity, plunged to the depth of between two and three inches under the ſurface of the liquors above-mentioned, which were ſeverally put into the ſmall glaſs jar F. The phial being then ſtopped, the ſtream of hepatic air, iſſuing through the tube, paſſed through a conſiderable part of the liquors and eſcaped at their ſurface; there the black colour firſt appeared; the tranſparency of the lower parts was not diſturbed, unleſs by the ſubſidence of the precipitate formed at the top.



The ſame concluſion is ſuggeſted by the following obſervation. On lifting up the tubulated phial, part of the liquor remained ſuſpended

ſuſpended in the tube; this liquor abſorbed hepatic air at its upper ſurface, and therefore mounted in the tube. No diſcoloration was perceived until a bubble of atmoſpheric air ruſhed through the liquor to ſupply the vacuum in the phial. The liquor then immediately became black.

We know that hepatic air is decompoſed by vital air, and ſulphur is precipitated. May not this ſulphur, thus ſet at liberty, unite with the lead (reduced in part by the inflammable air of the elaſtic fluid) and thus form a kind of galena in the humid way?

Lime water, added to a ſolution of ſugar of lead, firſt produces a precipitate, which it afterwards rediſſolves: On ſtanding, laminated cryſtals of an olive colour are formed.